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The Securities and Exchange Commission (SEC) required NASDAQ to alter its trading rules in early 1997. The new rules, collectively referred to as the Order Handling Rules (OHR), resulted from the SEC's investigation into the market-making practices of NASDAQ dealers after Christie and Schultz (1994) and Christie, Harris, and Schultz (1994) suggested that the market makers colluded to maintain artificially wide spreads. The OHR affected orders in the following main ways: limit orders that improved a market maker's quote were to be displayed, those that matched a market maker quoting the national best bid or offer (NBBO) were to be added to the depth, and market maker quotes submitted to an Electronic Communications Network (ECN), as opposed to NASDAQ, that were at the NBBO were to be displayed for all NASDAQ participants to see (Securities and Exchange Commission, 1996). These rules effectively made the multi-dealer market handle limit orders similar to a specialist market.

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Even though the OHR were introduced a few years ago, institutional investors and managers of firms whose stock is held and traded by institutions may find this study useful because previous papers investigating the effects of the OHR focused primarily on retail transactions. Moreover, critics of the OHR argued that NASDAQ dealer profits would be cut so much that market liquidity would suffer as a result of fewer dealers making markets. The criticism only grew louder before the minimum allowable change in quotes for stock prices (the tick size) was reduced later the same year. Whether dealer profits were harmed to the point that market liquidity was reduced for institutional traders (also known as block traders) is the question that this study sought to answer.

Besides the potential effect on market liquidity levels, the introduction of limit orders may also be of interest to institutional traders since exposing limit orders changed the amount of information regarding supply and demand that was available. For example, when working a block, dealers and traders can now see prices and depths that were previously unavailable to them. This information helps block traders gauge prices and quantities when negotiating to lay-off their trades.

This study analyzes changes in block trade price impacts around the introduction of the OHR. Also investigated is the effect of the reduction in minimum tick size. Lastly, NASDAQ block trade execution costs under the new OHR and reduced tick size regimes are compared to those for a market value-matched sample of New York Stock Exchange (NYSE) firms.

Previous Research

Why Limit Orders Matter

Both theoretical and empirical studies suggest that the introduction of limit orders on NASDAQ will affect the trading environment. Handa and Schwartz (1996) modeled limit order usage and showed that the orders are important for decreasing short-run price variability and that "patient" traders strategically place limit orders. Consistent with this, Keim and Madhavan (1995) studied 21 institutions between 1991-1993 and concluded that institutions that are passive traders are more likely to use limit orders. Huang and Stoll (2001) compared the trading characteristics of 19 stocks traded in both London and on the NYSE as ADRs. Since firm characteristics were automatically controlled for, the results were due to market structure differences between auction and dealer markets, a main one of which is whether limit orders exist. Chung, Van Ness, and Van Ness (1999) found empirical evidence that a large portion of posted bid-ask quotes originate from the limit order book rather than the NYSE specialist. Indeed, Huang and Stoll (1996) analyzed 175 matched pairs of NASDAQ and NYSE firms prior to the introduction of limit orders on NASDAQ and concluded that the presence of limit orders on the NYSE helped reduce trading costs in that market.

Earlier Research on the Effects of the OHR

Previous studies, which focused primarily on retail transactions, on the effects of the OHR found spreads generally declined after the event. Barclay et al. (1999) investigated the first 100 firms phased in and found this to be especially true among firms that had relatively wide spreads prior to the new rules and for smaller trade sizes. They also determined that even though average trade size declined, the total depth available increased. Consistent with those findings, McInish et al. (1998) analyzed the first 150 firms subject to the new rules and reported narrower spreads and smaller average trade sizes after the rules were introduced. Meanwhile, NASD (1998) determined that the change in minimum tick size had a larger effect than the OHR on the trading environment for high-priced, actively traded NASDAQ stocks.

While the evidence indicates that the rules generally improved the trading environment, this paper attempts to capture for block traders specifically the net effect from the increased quoted depth (potentially beneficial for block traders), the smaller average transaction size (could make it harder for blocks to transact), and the change in minimum stock price increments. Two studies that did analyze different trade volume categories lumped trade sizes of 10,000 shares or more together (Barclay et al., 1999; Bessembinder, 1999). Given that institutional investors are more likely to trade these sizes than retail investors, this study focuses specifically on block-size trades to analyze primarily whether the new OHR harmed or benefitted institutions. Because the minimum tick size changed only a few months after the event day—June 2 for NASDAQ, June 24 for NYSE—this effect was also investigated. Lastly, an inter-market comparison was performed for completeness.

Methodology and Results

Sample Construction and General Methodology

The sample used consisted of the 50 firms phased-in on February 10, 1997. The NYSE TAQ database provided all transaction information for 20 trading days before and after the event day. Trades had to be time-stamped between 9:30 a.m. and 4:00 p.m. and were excluded if flagged as delayed/reopening, aggregated/bunched, or reported out-of-sequence. Because NASD (1998) found share price to be an important variable in explaining cross-sectional differences in the effects of OHR and tick size changes and to mitigate pre-event differences in liquidity, market value-based portfolios were used to conduct tests. The portfolios were numbered in descending order; thus, Portfolio 1 contained the ten largest firms, which had an average market value of $10,624 million, while Portfolio 5 contained the ten smallest firms and averaged $338 million in firm market value.

In the spirit of LaPlante and Muscarella (1997), who also used non-proprietary data to study block trades, this study used transaction prices to measure liquidity instead of spreads. The author lists several reasons why transaction prices, rather than quotes, may provide more appropriate measures of

trade costs, particularly for blocks. Two other reasons specific to this study for using transaction prices were that ECNs quotes in smaller increments than NASDAQ were capable of showing while transaction prices reflected the actual price at which trades occurred, regardless of the increments and that Bessembinder (1999) documents highly variable delays in trade reports by NASDAQ dealers that could bias measures using prevailing quotes. Hence, price impacts were measured as the natural log difference between the block trade price and the previous trade price.

Lastly, to further analyze changes in block activity, trades were classified as having occurred on downticks (the block trade price was lower than the previous trade price), zeroticks (the block trade price was the same as the previous trade price), or upticks (the block trade price was higher than the previous trade price). Changes in the relative proportions of these types of trades can provide insight into how trade execution changed. Further, to capture the change in the degree to which blocks transacted on zeroticks, and simply to capture the smaller magnitude of price impacts, the average of absolute price changes was calculated. In this manner, a smaller mean absolute price impact following the introduction of the OHR would reflect blocks traded more frequently with smaller or no impact.

Results for the Introduction of Order Handling Rules

Table 1 reports the average costs of trading across all the blocks and by various block sizes. Beginning with the average for all blocks, Portfolio 1 (largest market value firms) shows the smallest reduction in price impact, from 0.24 percent to 0.23 percent. The largest-sized firms appear to have benefitted the least. The change in Portfolio 2 is larger, from 0.30 percent to 0.26 percent, and the change for Portfolio 3 firms is larger still, from 0.33 percent to 0.26 percent. Portfolio 5 firms, the smallest-sized firms, experienced the largest reduction in block price impact, from 0.78 percent to 0.58 percent.

Considering the various size categories, the firms comprising Portfolio 1 experienced significant reductions for the 20,001-30,000 and over-50,000 share block size categories. In comparison, Portfolios 2, 3, and 5 benefitted from smaller price impacts for the relatively smaller blocks of 10,000 and 10,001-20,000 share sizes. Here, again, the small firms comprising Portfolio 5 incurred the greatest reduction in price impacts, from 0.75 percent to 0.61 percent and from 0.92 percent to 0.55 percent, respectively.

Since these price improvements could occur simply from smaller blocks being transacted, average block trade sizes were compared from before to after the OHR were introduced. No statistically significant changes in the average sizes, even when blocks were grouped by whether they occurred on downticks, zeroticks, or upticks occurred. The only exception was firms comprising Portfolio 3. Their blocks that transacted on zeroticks showed a statistically significant change, from a mean of 18,100 shares to 16,800 shares.

Even though average block trade sizes did not change significantly, Table 1 revealed some firms experienced significant reductions in price impacts. Another measure often used to compare changes in market liquidity is the "temporary price effect" of a block transaction. This measure attempts to capture that portion of a price change incurred as a liquidity concession and to ignore that portion incurred to incorporate relevant information. The methodology of Holthausen et al. (1990) was used to calculate

$$\ln(\text{Price}_t / \text{Price}_{t+i}) \qquad (1)$$

where t is the block trade and i is the number of subsequent trades. Because of a lack of an agreed upon specific number of "subsequent trades," measures for the following three transactions were calculated. Reductions in liquidity costs for Portfolio 1 firms ranged from two to eight basis points while reductions for Portfolio 5 firms were a minimum of ten basis points and ranged as high as 44 points. The 10,000-share trade size category showed lowered liquidity costs for up to three trades for nearly all the portfolios. Significant gains in liquidity were more sporadic for the larger trade sizes.

To summarize so far, benefits for block trades from the OHR appeared to have accrued for all size firms, but by far the largest gains accrued to the smallest firms in the sample. While transaction size generally did not

TABLE 1
AVERAGE ABSOLUTE PERCENTAGE PRICE IMPACTS

Number of Shares	Portfolio 1 (Largest)		Portfolio 2		Portfolio 3		Portfolio 4		Portfolio 5 (Smallest)	
	Before	After	Before	After	Before	After	Before	After	Before	After
All blocks	0.24	0.23 *	0.30	0.26 *	0.33	0.26 **	0.49	0.43	0.78	0.58 ***
10,000	0.23	0.22	0.29	0.25 **	0.33	0.25 **	0.49	0.40	0.75	0.61 **
10,001-20,000	0.23	0.23	0.29	0.25 **	0.33	0.25 *	0.46	0.45	0.92	0.55 **
20,001-30,000	0.26	0.22 **	0.29	0.29	0.34	0.29	0.41	0.43	0.79	0.61
30,001-50,000	0.26	0.23	0.31	0.29	0.33	0.28	0.98	0.45	0.64	0.62
>50,000	0.33	0.24 **	0.34	0.32	0.33	0.42	0.73	0.43 *	0.76	0.50

***, **, * Wilcoxon rank sum test indicates the mean is significantly smaller at the 1%, 5%, or 10% confidence level, respectively

change in any significant manner, evidence of smaller price impacts on both a total and temporary basis.

Results for the Reduction in Tick Size on NASDAQ

A comparison of the mean absolute price impacts for the 20 days before and after the minimum tick size changed showed the reduction in tick size led to lower block trading costs for large firms. Portfolio 1 firms, the largest-sized, showed more and larger significant reductions in block trade price impacts following the change in tick size than compared to the introduction of the OHR. For example, the average price impact for all blocks in Portfolio 1 decreased by five basis points, and significant reductions in the 10,000, 10,001-20,000 and 30,001-50,000 share block size categories occurred.

The significance and number of significant price impacts for the large firms in Portfolio 1 contrasted with the results for the smaller firms. Portfolio 2 firms showed fewer reductions, Portfolio 3 firms incurred no significant changes, and Portfolios 4 and 5 experienced reduced costs for the 10,001-20,000 share-size blocks only.

Post-Reform Block Price Impacts for NASDAQ Versus the NYSE

The last item investigated was whether the rule changes on NASDAQ made block trade price impacts comparable to those on the NYSE. Tests were conducted using block trade data for the month of July 1997, during which both markets were trading at the minimum tick size of $1/16^{th}$. Each of the NASDAQ firms was matched (without replacement) with a NYSE firm based on closest market value.

Mean absolute price impacts were significantly smaller for NYSE-traded blocks in all portfolios and volumes, except for the over-50,000 category, which showed few significant differences. Relative to block execution on the NYSE, block traders of large NASDAQ firms appeared to benefit more from the rule changes than traders of smaller NASDAQ firms. Specifically, a pattern of an increasing difference in the averages as firm size decreased emerged, and it was nearly consistent across all the different volume categories. For example, the absolute price impact averages for all blocks showed the differences between the matched samples increased as firm size decreased, from 0.07 percent for firms in Portfolio 1 to 0.36 percent for firms in Portfolio 5.

While this and other studies found that small firms gained from the introduction of the OHR in the form of smaller spreads and reduced trading impacts, the evidence reported in this study regarding immediate price impacts suggests that the "playing field" for block trade execution has become more level between the NASDAQ and NYSE for transactions in large firms, but block traders in small firms

continue to receive better execution on the NYSE.

For completeness, temporary effects were also calculated and compared between the matched samples. Results showed that the NYSE firms incurred significantly smaller temporary effects for practically all portfolios across all volume categories and as measured for up to three trades later. The pattern observed earlier, in which the difference in price impacts between matched samples increased as firm size decreased, was again repeated. For example, comparing all blocks showed that trades in Portfolio 1 incurred an average temporary change in price, relative to the following transaction, of 0.16 percent on NASDAQ versus 0.06 percent on the NYSE while the averages for Portfolio 5 firms were 0.57 percent versus 0.13 percent, respectively. Considering the various volume categories revealed the same pattern. That is to say, NYSE firms had smaller temporary block price impacts regardless of firm or trade size.

Conclusion

In January 1997, the SEC imposed new Order Handling Rules on NASDAQ market makers that required dealers to display limit orders to other market participants. It was widely felt at the time of implementation that the OHR were instituted for the benefit of retail traders, perhaps even to the detriment of institutional traders since dealer profits were expected to be reduced to the point that market liquidity would suffer. Because previous studies on the effects of the OHR focused on retail trades and analyzed transaction sizes for 10,000 shares or more as a single, trade size category, this study investigated whether the new rules also affected the liquidity of block trades, those trades most likely to be conducted by institutional investors.

Contrary to those concerns, this study shows that blocks traded with significantly lower price impacts after the new OHR, especially for medium- and small-sized firms. The lower price movements were primarily found for block transactions under 30,000 shares.

Also investigated was the reduction in tick size. It was found that only the largest firms realized significant declines in block price impacts due to this change.

Lastly, comparisons of NASDAQ block trades with a matched sample of NYSE firms revealed that both markets significantly reduced block price impacts compared to previous time periods. However, while NASDAQ showed dramatic declines in the cost of trading blocks, the NYSE still had significantly lower price impacts across all size firms and all block sizes. It is noteworthy that the difference in block price impacts for large firms on NASDAQ and the NYSE were found to have dropped from 16 basis points in 1990 to seven basis points in 1997.

It appears that the new OHR and reduced tick size improved the liquidity of NASDAQ securities as measured by both spreads and block price impacts. The SEC and NASDAQ can claim that the new regulations improved the trading not only for individual traders but for institutional traders as well.

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